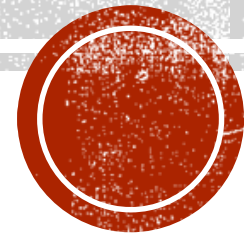


TRANSFORMATIONS OF FUNCTIONS

Honors Calculus

Keeper 4



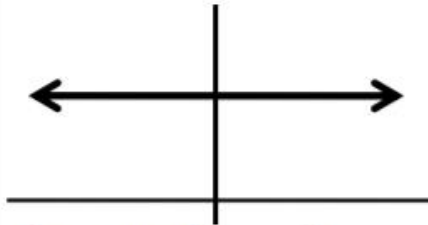
$$f(x) = a(x-h)^2 + k$$

$$f(x) = a\sqrt{x-h} + k$$

p. 8

$$f(x) = a|x-h| + k$$

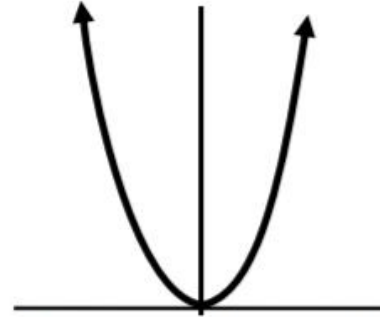
$$f(x) = a \text{ number}$$



Domain: $(-\infty, \infty)$

Range: the number

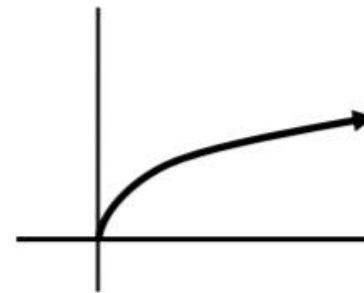
$$\text{Parabola: } f(x) = x^2$$



Domain: $(-\infty, \infty)$

Range: $[0, \infty)$

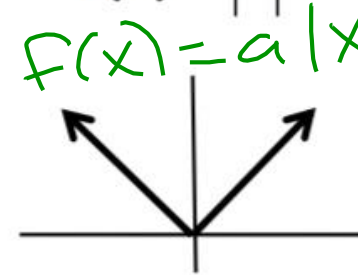
$$f(x) = \sqrt{x}$$



Domain: $[0, \infty)$

Range: $[0, \infty)$

$$f(x) = |x|$$

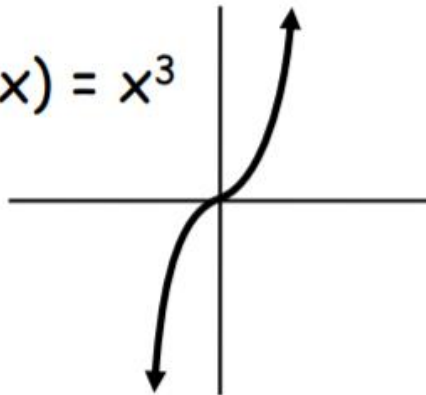


Domain: $(-\infty, \infty)$

Range: $[0, \infty)$

Library Function Graphs

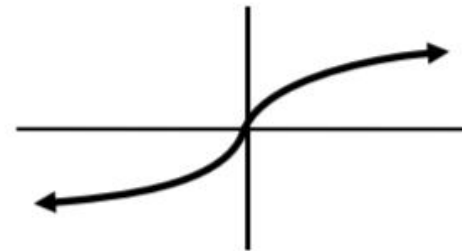
$$f(x) = x^3$$



Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

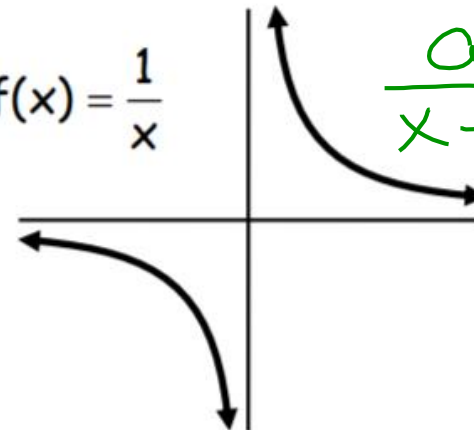
$$f(x) = \sqrt[3]{x}$$



Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

$$f(x) = \frac{1}{x}$$



Domain: $(-\infty, 0) \cup (0, \infty)$

Range: $(-\infty, 0) \cup (0, \infty)$

$$\frac{a}{x-h} + k$$



RULES FOR TRANSFORMATION OF FUNCTIONS

Transformation	Function	Description
☆ Horizontal Shift <i>n is opposite of what you see</i>	$f(x + h)$	$-h$ Shift left h units
	$f(x - h)$	$+h$ Shift right h units
Vertical Shift	$f(x) + k$	Shift up k units
	$f(x) - k$	Shift down k units
Reflection	$-f(x)$	Reflect across x-axis $y = -x^2$
	$f(-x)$	Reflect across y-axis $y = (-x)^3$
Vertical Stretch/Compress	$a f(x), a > 1$	Stretch vertically by a factor of a $y = 2x^2$
	$a f(x), 0 < a < 1$	Compress vertically by a factor of a $y = \frac{1}{2}x^2$
☆ Horizontal Stretch/Compress <i>stretch/compress is reciprocal of what you see</i>	$f(ax), a > 1$	Compress horizontally by a factor of $\frac{1}{a}$
	$f(ax), 0 < a < 1$	Stretch horizontally by a factor of $\frac{1}{a}$



DESCRIBE THE TRANSFORMATION & ~~SKETCH THE GRAPH~~

$$1. g(x) = \frac{2}{3}x^2 - 1$$

$$a = \frac{2}{3} \quad h = 0 \quad k = -1$$

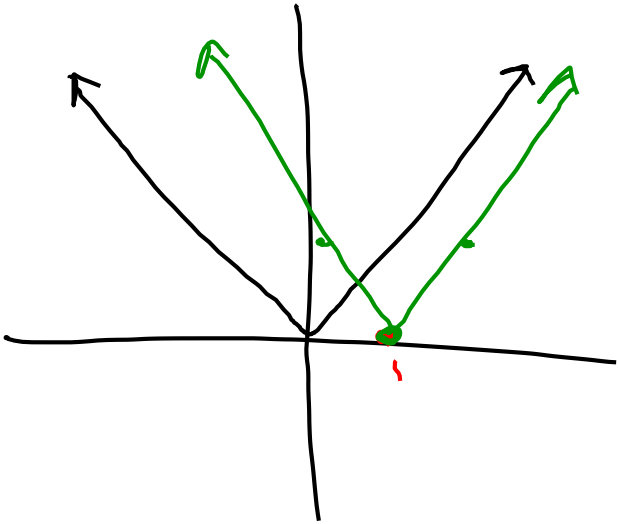
compress vert. by $\frac{2}{3}$
& down 1



$$2. g(x) = 2|x - 1|$$

$$a=2 \quad h=1 \quad k=0$$

Stretch vert. by 2
& right 1



$$3. g(x) = -2(x + 1)^2 + 3$$

$$a = -2 \quad h = -1 \quad k = 3$$

-1.2

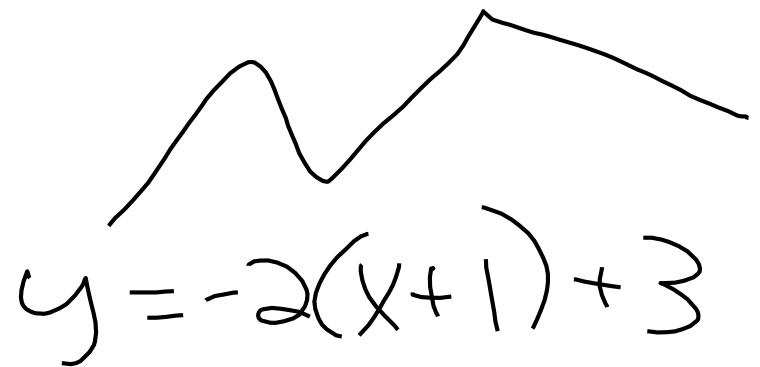
reflect over x-axis
stretch by 2 (vert.)

left 1 & up 3

↓
affects
x-coord.

↑
affects
y-coord.

> multiply
y-coord.
by -2



$$4. \ g(x) = -3x - 2$$



WRITE THE EQUATIONS DESCRIBED...

1. Absolute Value – vertical shift up 5,
horizontal shift right 3 $h=3$

$$y = |x - 3| + 5$$

$x - h$



2. Linear – vertical compression by $\frac{2}{5}$ & up 2

$$f(x) = \frac{2}{5}x + 2$$



3. Quadratic – vertical stretch by 5,
horizontal shift left 8, reflected over the x-
axis.

$$g(x) = -5(x + 8)^2$$

